

TEACHERS COLLEGE COLUMBIA UNIVERSITY



Linking Food
and the
Environment



Growing Food

AN INQUIRY-BASED SCIENCE AND NUTRITION PROGRAM

Funded by National Institutes of Health (NIH),
National Center for Research Resources (NCRR),
Science Education Partnership Award (SEPA)

Vision



To promote scientific habits of mind through thoughtful inquiry-based activities that study food, food systems, and environmental and personal health.

QuESTA Learning Cycle



Questioning



Experimenting



Searching



Theorizing



Applying to Life

Growing Food



How does nature provide us with food?



UNIT 1

Becoming Food Scientists

Unit 1 question:
What is a food scientist?



UNIT 2

Plants

Unit 2 question:

If there were no plants, would
humans have food?

A black and white photograph of a flower head, likely a thistle, with a dense cluster of small florets. A single petal is visible below the head, and a small wasp is perched on it. The background is dark and out of focus.

UNIT 3 Food Webs

Unit 3 question:

How do components in nature
interact with each other?



UNIT 4

Agriculture

Unit 4 question:

How do we interact with nature
to meet our food needs?



UNIT 5

Making Choices

Unit 5 question:

How can we use the science
we learned to make food and
agriculture choices?

Working with Soil

OVERVIEW

This lesson introduces students to the important role soil plays in a plant's growing cycle. Through this lesson we hope students will come to value that farmers need knowledge about how to build healthy soil. Through hands-on investigations of local soil samples, students discover the characteristics of a "healthy" soil system. Students compare two soil samples: One sample comes from a place where no plants are growing; the other from a place where plants are growing. By carefully examining soil, it's possible to see and feel the soil's texture and components. With the use of a hand lens, you can see even more, possibly discovering some of the invertebrates that thrive in a "healthy" soil ecosystem. Students also learn about the different inorganic components of soil through a "shake-n-settle" activity. They synthesize what they learned through building new theories about soil. In their LiFE Logs they apply this new knowledge through finishing the paragraph, "If I were a farmer growing . . ."

MATERIALS

For the teacher:

- *Soil Layers* lesson resource
- *Healthy Soil* lesson resource
- 2 clear glass or plastic jars with secure lids
- Water (enough to fill the two jars)
- Two labels, one for each jar
- Felt-tip pen

For each group of 3–5 students:

- 1 cup sterile soil sample
- 1 cup fertile soil sample
- 2 paper plates
- One sheet of newsprint or butcher paper

- Felt-tip pens

- (Optional) Hands lenses and/or magnifying glasses
- (Optional) One copy *Healthy Soil* lesson resource

For each student:

- *What Makes Soil "Healthy?"* student reading
- *Soil Observations* experiment sheet
- *Shake-n-Settle* experiment sheet

AIM

To understand what makes soil healthy.

SCIENTIFIC PROCESSES

- observation, investigation, speculation

OBJECTIVES

Students will be able to:

- gain new understandings of soil through hands-on soil investigations
- describe the characteristics of a "healthy" soil ecosystem
- discuss why farmers need to understand the characteristics of a "healthy" soil ecosystem

PROCEDURE

Before you begin:

- If you have not already done so, collect soil samples. You will need samples large enough to provide each group of students with at least one cup of each soil sample. Be sure that one sample is sterile soil. Collect it from a place where plants are thriving.
- Prepare the labels for the two jars. Write “Nothing Growing” on one label. Write “Plants Growing” on the other label.
- Follow the blackline master instructions for setting up the *Soil Observations* and *Shake-n-Settle* demonstration.
- Make copies of *What Makes Soil “Healthy?”* to distribute to students at the end of this lesson.

MODULE QUESTION

How does nature provide us with food?

UNIT QUESTION

How do we interact with nature to meet our needs?



QUESTIONING

1. Review Module and Unit Question

Explain that in this lesson the class is going to learn about soil: what soil is made of, what makes soil healthy, and why farmers need to know about soil. This adds to what we have already learned about how we interact with nature to grow our food.

2. Think about Soil

Write the word **soil** on the board. Engage students in a discussion of the term to assess their current understanding. Record students’ thoughts on the board. Accept all answers.

What do you already know soil? Invite students to share the soil observations they did for

homework. Encourage students to think about what they have already learned about soil through their seed planting activity and what they have learned about decomposition.

What would you like to learn about soil? Students may be curious about the difference between the words **soil** and **dirt**. Challenge them to distinguish between the terms.

3. Discuss Soil’s Role in Food Production

If necessary, remind students that soil is essential for growing plants. As you bring the discussion to a close, elicit students’ ideas about the role soil plays in maintaining life.

Explain that the quality and characteristics of soil determine how well plants will grow. Before farmers ever plant seeds they observe the soil very closely. Observation is a great way to learn about soil, you can learn what it already contains and what might need to be added.



EXPERIMENTING

4. Conduct the Soil Investigations

Have students work in small groups. Introduce the soil investigations.

We will conduct two simple experiments with our soil samples. Hold up the samples for all to see. *This sample is labeled “Nothing Growing.” This sample is labeled “Plants Growing.”* (If the samples came from locations close to school, let students know where you collected the soil.)

How do we set up the investigation? Have students follow along on the *Soil Observations* activity sheet. You may wish to have a student volunteer read the instructions out loud. Remind students to record their observations on the activity sheet as they examine the soil samples and to summarize their finding on their newsprint sheet to present to the entire class.

5. Shake-n-Settle Demonstration

Preparation

Set up the demonstration while students are working on their *Soil Observations* activity sheet. Follow the procedure outlined on the *Shake-n-Settle* experiment sheet. Wait until students have completed the *Soil Observations* before adding the water to each jar.

Show the students the jars with the soil and ask, *What do you think will happen if we add water to these jars and shake them?* Accept all answers. Record them on the board so students can look back at their ideas.

Have students take out their *Shake-n-Settle* activity sheets. Invite two volunteers to add the water. Record the time, and then shake the jars. Make certain the lids are securely tightened. Place the jars in a spot where the contents can settle without being disturbed. Ask for a student volunteer to keep track of the soil and water mix. Have that student record what time it is when the layers are formed. Record the time on the board so the class can record it on their activity sheets.

6. Summarize Soil Observations

While the contents are settling, invite students to share their soil observations with the class. Invite a student representative from each group to post the newsprint with the group's observations and to share them with the class. Encourage other groups to ask questions and compare their findings.

7. Shake-n-Settle Observations and Data

What do you think happened? Students make predictions. Record them.

You may wish to have students work in their small groups to observe what has happened to the soil and water mix. If you use plastic jars, you can pass the jars around to each group. Be careful not to shake the jars once the soil has settled into layers. You may find it is easier to control this demonstration by keeping the jars level and in one spot. Have students take turns making their observations.

What data do you have? Students share their findings.

What can you infer? Help students see that the soil settles by the weight of the particles. The heaviest particles settle on the bottom; the lightest on the top.



THEORIZING

8. Construct Knowledge

What have you learned about soil? What evidence do you have to support your ideas? Why do you think soil is described as healthy or unhealthy?

Encourage students to consider the role that soil plays in food production. Ask students to reflect on these questions: *What did you observe that was different about the soil where plants were growing that makes plants able to grow? What is your evidence? Why do you think soil is described as "healthy" or "unhealthy?" Based on what you have learned, how would you describe "healthy" soil? Do you think it is important for farmers to have "healthy" soil? Explain your answer.*

9. LiFE Log

Have students write the following in their LiFE Logs: "If I were a farmer growing vegetables, I would carefully observe my soil. I would hope to find . . ." Ask students to write several sentences to complete the statement. Remind them to cite evidence from their own soil observations.



SEARCHING

10. Reading for LiFE

Distribute the Reading, *What Makes Soil Healthy?*



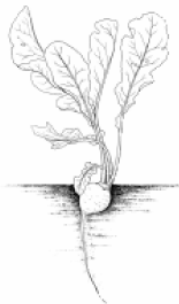
Name	Date
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RADISH

Raphanus sativas

ROOT CROP

Radishes are most often thought of as round and red, but can come in a wide variety of shapes and colors. Pink, purple, and white are other common colors. Radishes can be shaped like olives or carrots.



GROWING

Sow outdoors in full sun after all danger of frost. Cover seeds firmly with soil. When plants have 3 or 4 leaves, thin to 1 inch apart. For a steady crop, sow every 10 days until warm weather and again in fall until 30 days before frost. Radishes exhibit best flavor when grown in cool weather and full sun. Sun is very important for radishes. For mild radishes, mulch and keep watered to speed growth.

HARVESTING

When plants look nice and bushy, with lots of leaves, start checking under the soil to see how thick the radishes are. You can pick the radishes when they are about an inch thick, or you can wait for them to get a little bigger. You will know when radishes are really ready to pick when they start peeking out from under the soil.

COOKING

Delicate flavor, crisp and tender. Great in vegetable trays to add color and flavor. You can also pop radishes into your mouth whole, but it may take a bit of getting used to their strong flavor. If you are new to eating radishes, cut them up very small to accent a salad. High in vitamin C. Use thinnings in salads. Thinnings are the small plants you pull out when your plants seem to be too crowded.

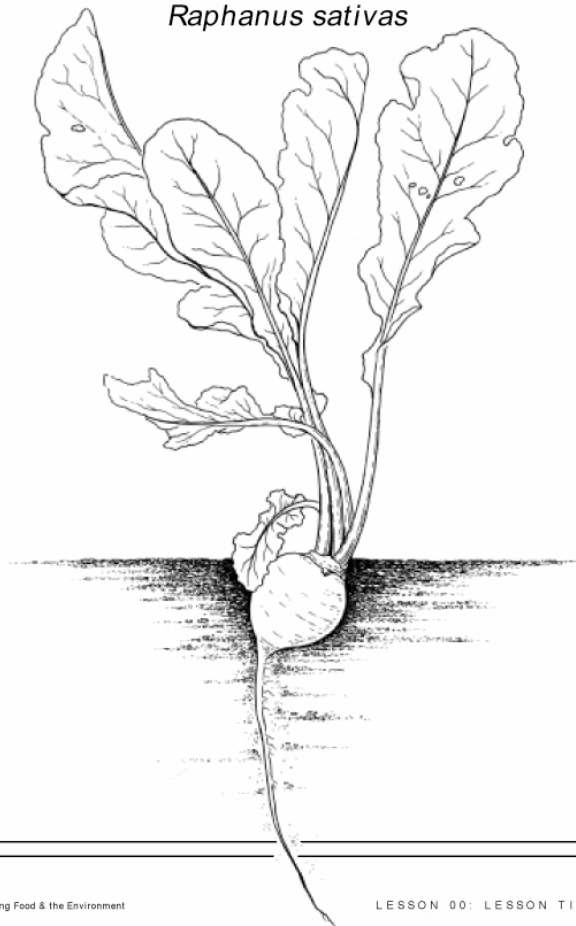
Best growth in the NY area	Days to germination	Days to harvest	Planting depth	Spacing Row/Plant	Preserve by
March-May & August	4-7	28	1/2 in.	12 in/1 in.	Fresh use only



Name	Date
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RADISH

Raphanus sativas





Name

Date

Soil Observations

	Soil Sample: PLANTS GROWING	Soil Sample: NOTHING GROWING
Look		
Smell		
Touch		
Living Creatures		

How are the soil samples alike:



Growing Food

AN INQUIRY-BASED SCIENCE AND NUTRITION PROGRAM

"My students are thinking deeply about food system issues. They get excited every time we do the lessons. I use LiFE as a replacement unit in our adopted science curriculum."

— NICK G., sixth-grade teacher

What is LiFE?

It's a thought-provoking, action-changing, inquiry-based curriculum that supports student investigations of topics in life science using a familiar domain—food. As food scientists students ask probing questions such as:

- Why are plants so special?
- How does nature work?
- Who grows our food?
- How does farming affect the environment?

LiFE's QuESTA Learning Cycle

Using QuESTA, students engage in learning science as a process. They

- **Q**uestion what they already know and what they want to learn;
- **E**xperiment through testing hypotheses, collecting data, and interpreting results;
- **S**earch to learn answers to questions;
- **T**heorize to develop new knowledge constructs; and
- **A**pply what they have learned to their daily lives.

LiFE Teacher Guides include:

- Lesson plans with helpful background information, practical teaching tips and tools for assessment
- Student activity sheets and readings
- A matrix that maps LiFE to the *National Science Education Standards* and *Benchmarks for Science Literacy*

Other LiFE Modules:

- Farm to Table and Beyond (grade 5 or 6)
- Food and Health (grades 5 or 6)
- Choice, Control, and Change (grade 6, 7, or 8)

For more information, contact us:

Web: www.tc.edu/life • Email: lifecatTC@columbia.edu • Phone: 212/678-3001



Choice Control and Change

(C3)

Unit 1 Healthy Bodies

What kinds of data can we collect
to better understand
our food and activity choices?

Unit 2 Human biology

How does the body work?

Unit 3 Moving toward health

How can we take control over making
food and activity choices that
improve our health?

Unit 4 Our food environment

How does the food and activity environment impact our personal food and activity choices?

Unit 5 Science of food choice

How can we create a healthful food environment for ourselves?

Unit 6 Confirming competence

What can I do to maintain my skills
as a competent eater and mover?



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